FIGURE 1A

FIGURE 1B

FIGURE 1C

FIGURE 2

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIGURE 3A

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
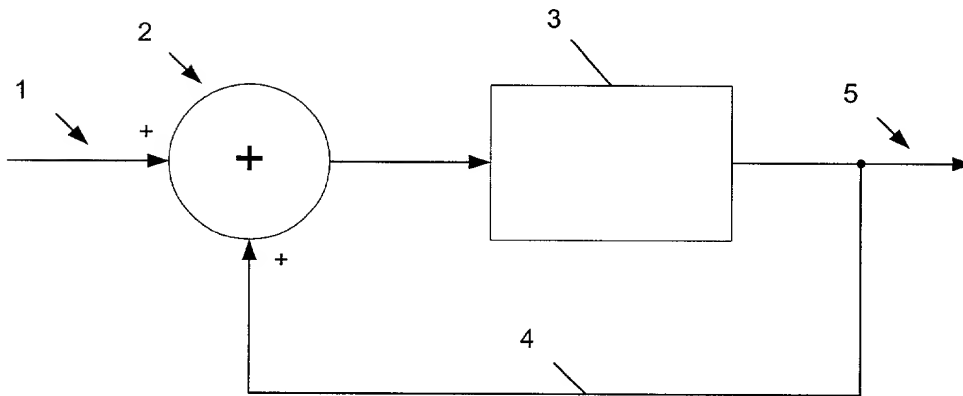Inventors: Donald B. Eidson, et al.
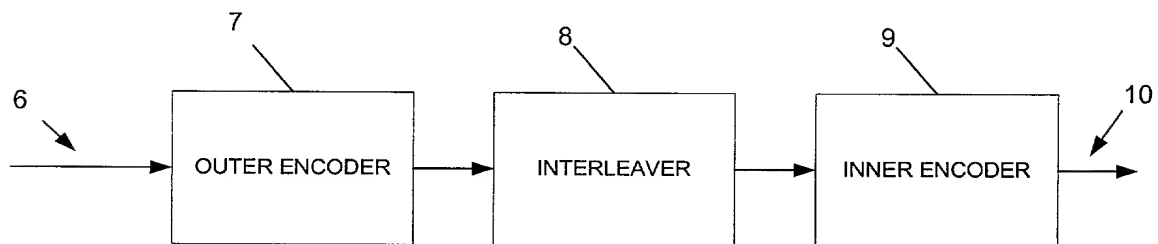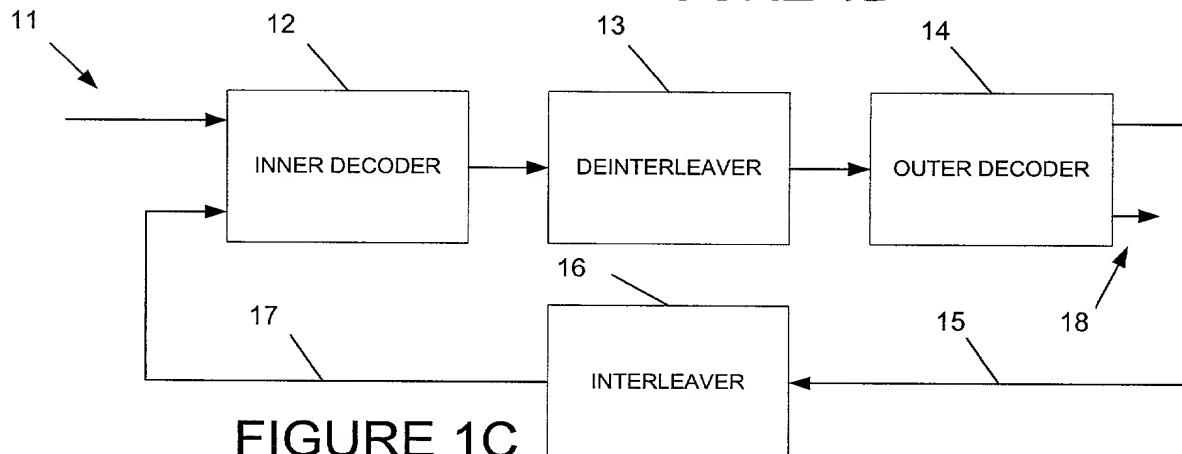Application No. 09/887,877

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FIGURE 3B

FIGURE 4

FIGURE 5

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
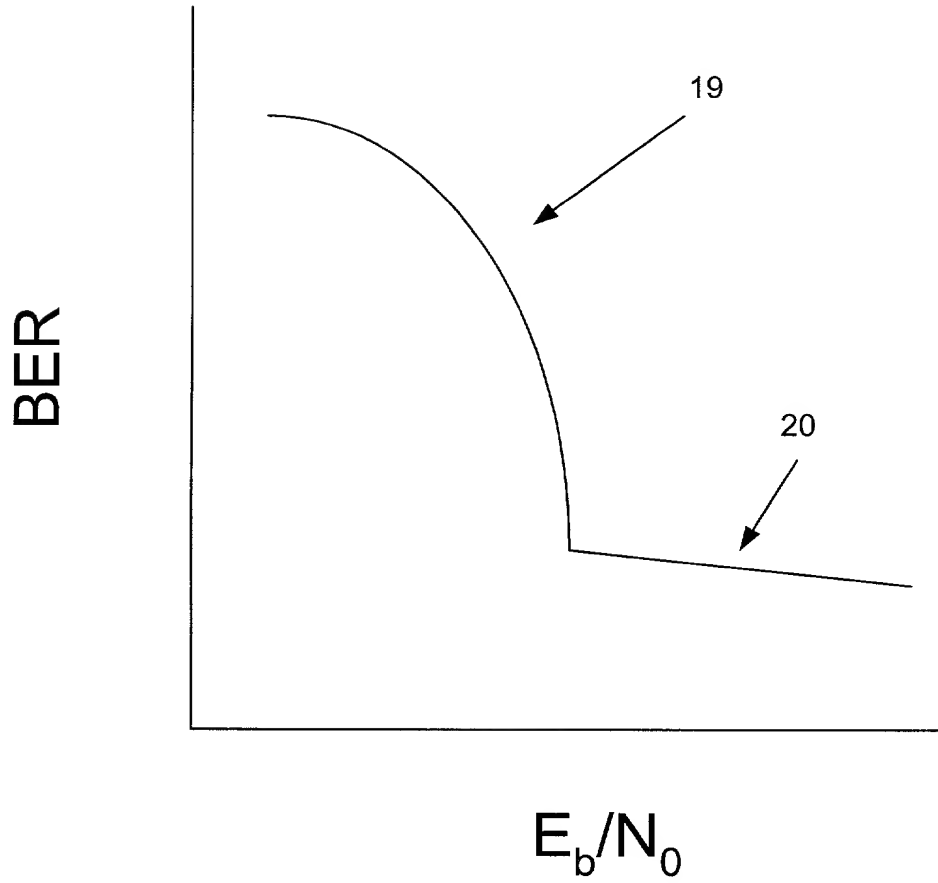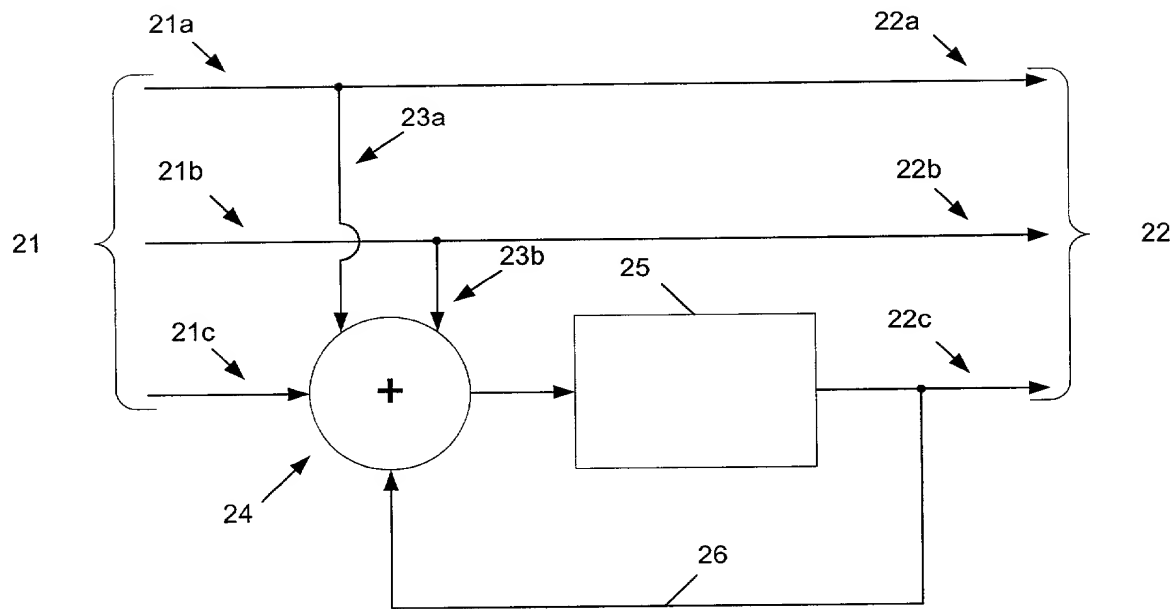Application No. 09/887,877

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FIGURE 6

**RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER**
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIGURE 7A

8-PSK SYMBOL INDEXING
(y_2, y_1, y_0)

FIGURE 7B

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
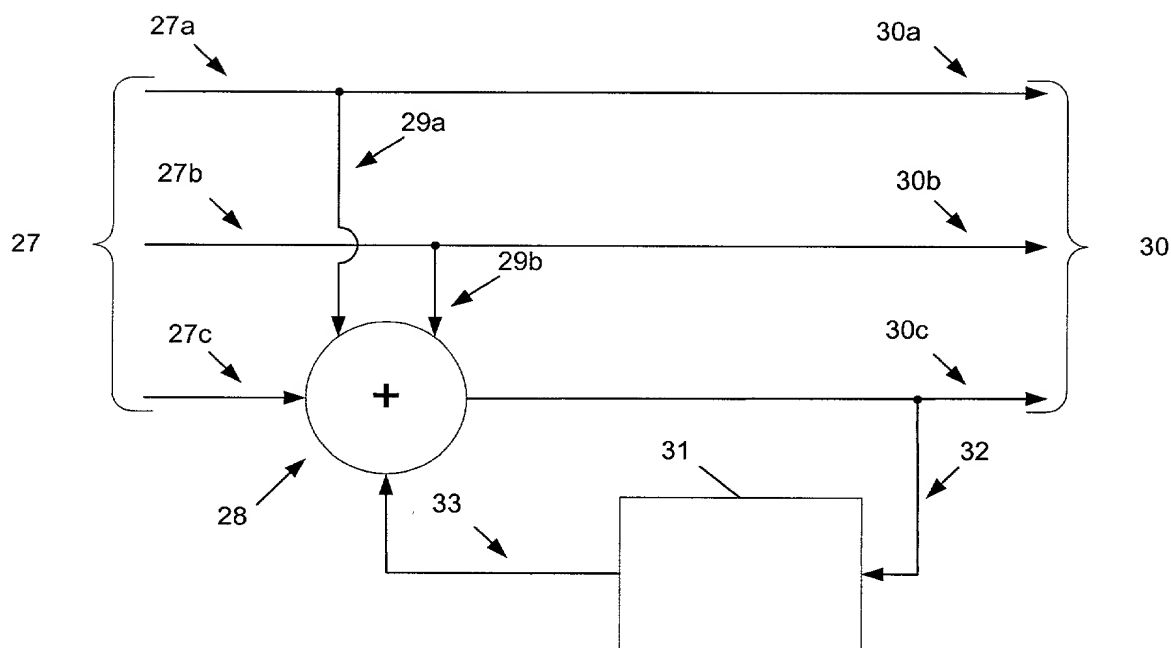Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIGURE 8A

8-PSK SYMBOL 1 INDEXING
(y_2^1, y_1^1, y_0^1)

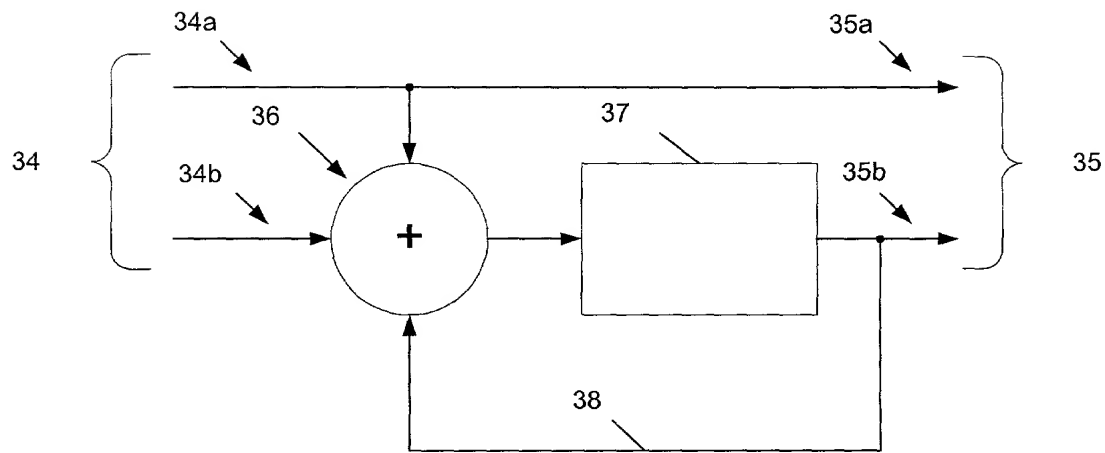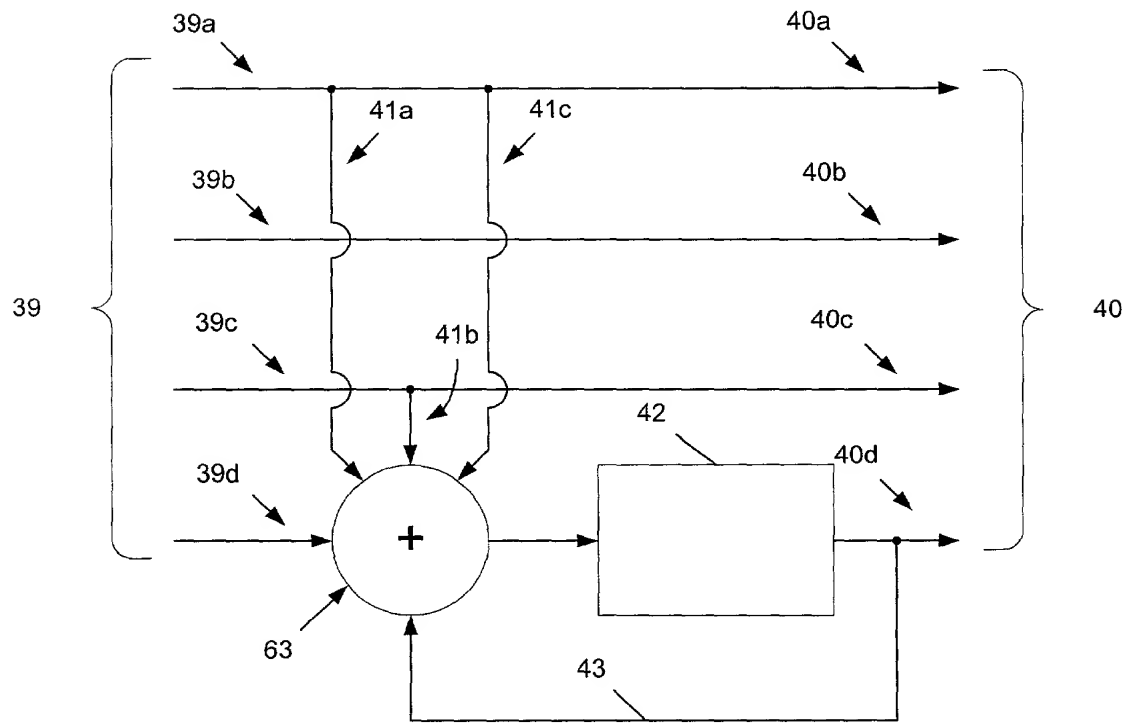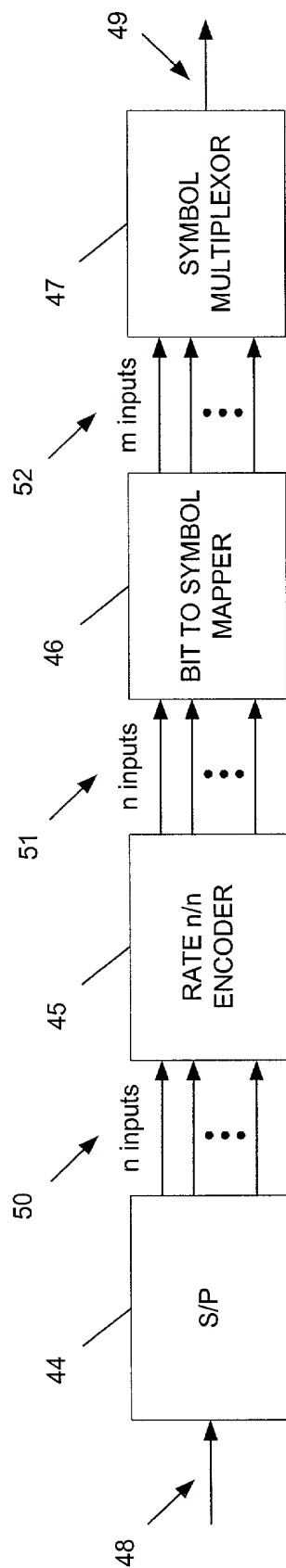8-PSK SYMBOL 0 INDEXING
(y_2^0, y_1^0, y_0^0)

FIGURE 8B

**RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER**
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIGURE 9A

16-QAM symbol indexing

(y_3, y_2, y_1, y_0)

FIGURE 9B

52 — PROVIDE n BIT INPUTS
TO RATE n/n
SYSTEMATIC,
RECURSIVE ENCODER

53 — RECEIVE n BIT
OUTPUTS FROM
ENCODER

54 — MAP n BITS INTO D-
DIMENSIONAL
CHANNEL SYMBOL

FIG. 10

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
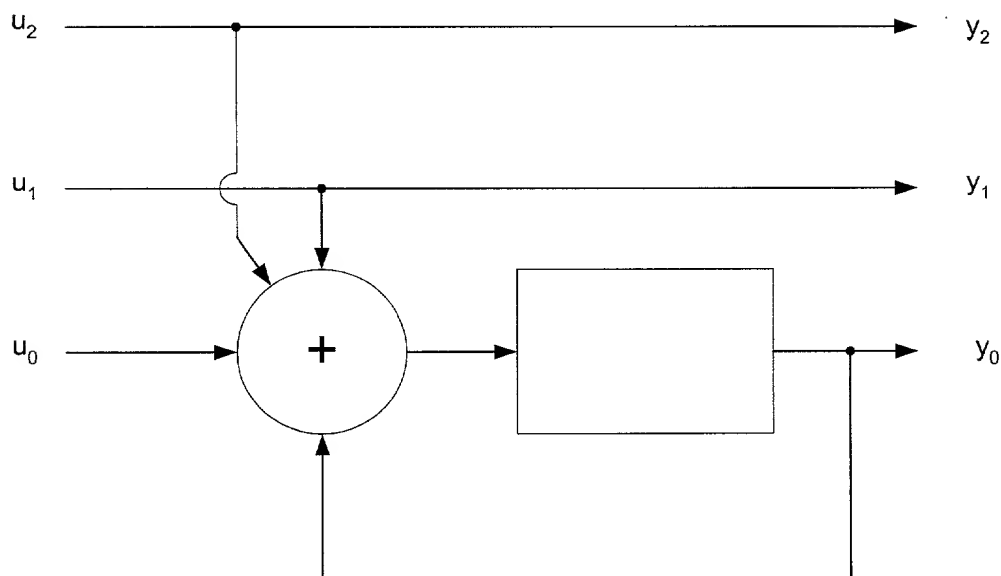Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIG. 11A

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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FIGURE 11B

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
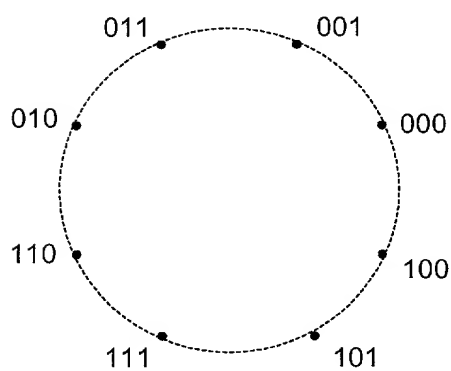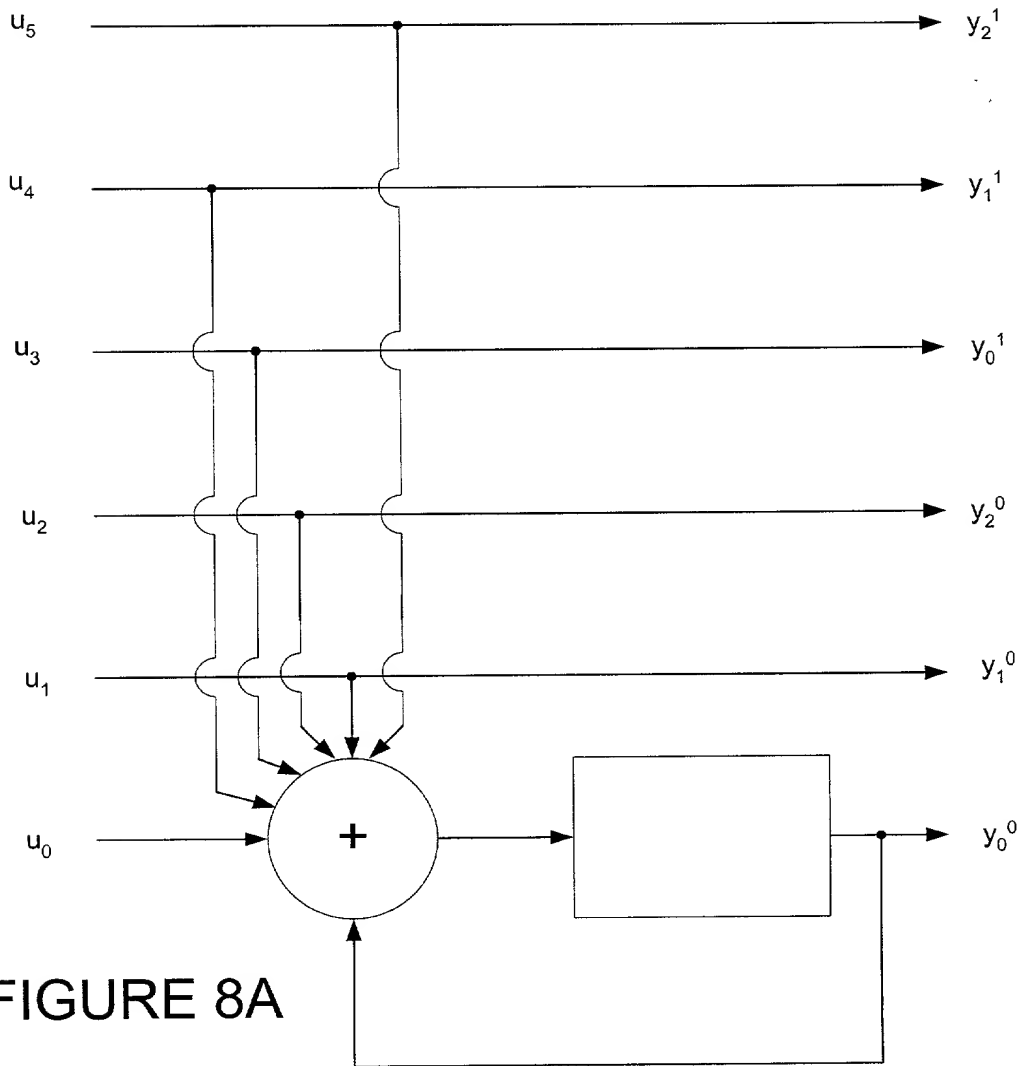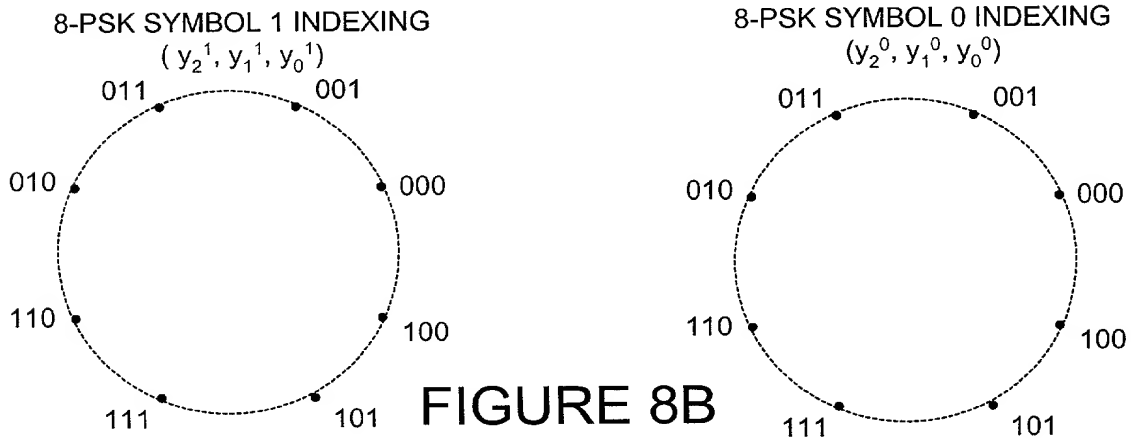ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
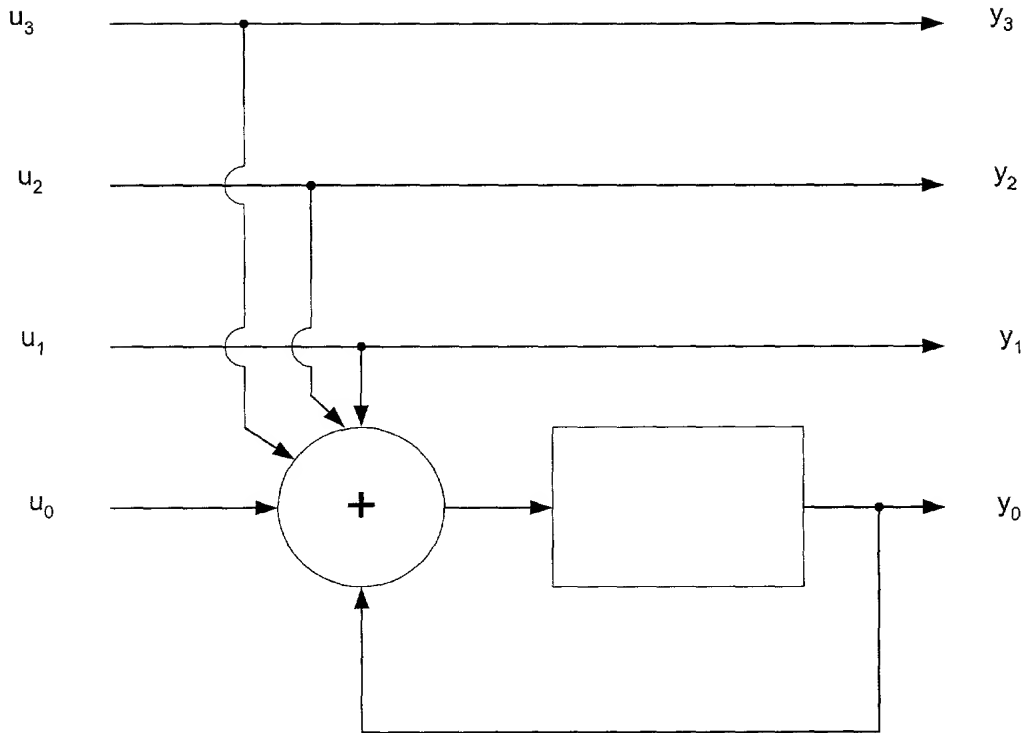Application No. 09/887,877

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FIGURE 11C

Rate 3/4 overall 8-PSK SCTCM performance: comparison of rate 3/3,
6/6, and 5/6 inner codes 15147-bit source data payload per block
(BER floor estimated using Union Bound)

FIG. 12A

Rate 5/6 overall 8-PSK SCTCM performance: rate 3/3 inner code vs rate 6/6 inner code 15125-bit source data payload per block (BER floor estimated using Union Bound)

Legend:
- ─□─ RATE 3/3 INNER, WATERFALL REGION, 6 *its*
- ─△─ RATE 6/6 INNER, WATERFALL REGION, 6 *its*
- ─□─ RATE 3/3 INNER, BER FLOOR
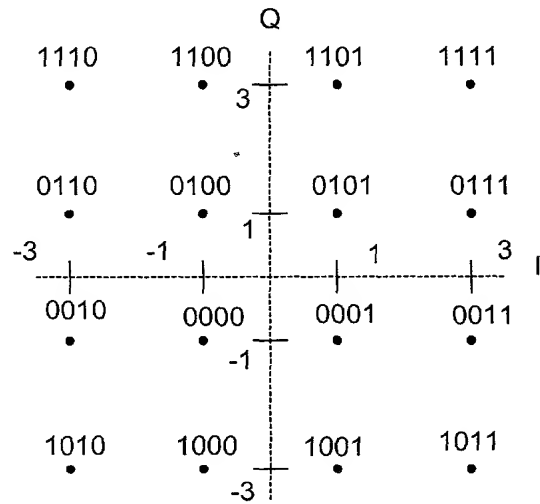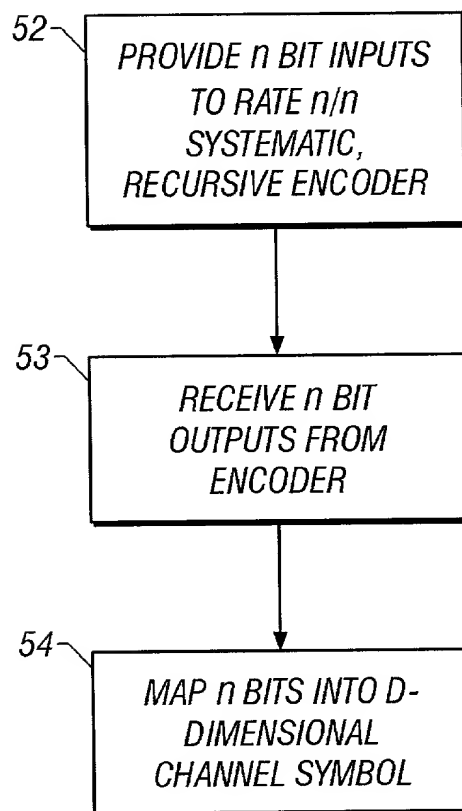- ─◇─ RATE 6/6 INNER, BER FLOOR
- ─✳─ SERIES 5

FIG. 12B

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
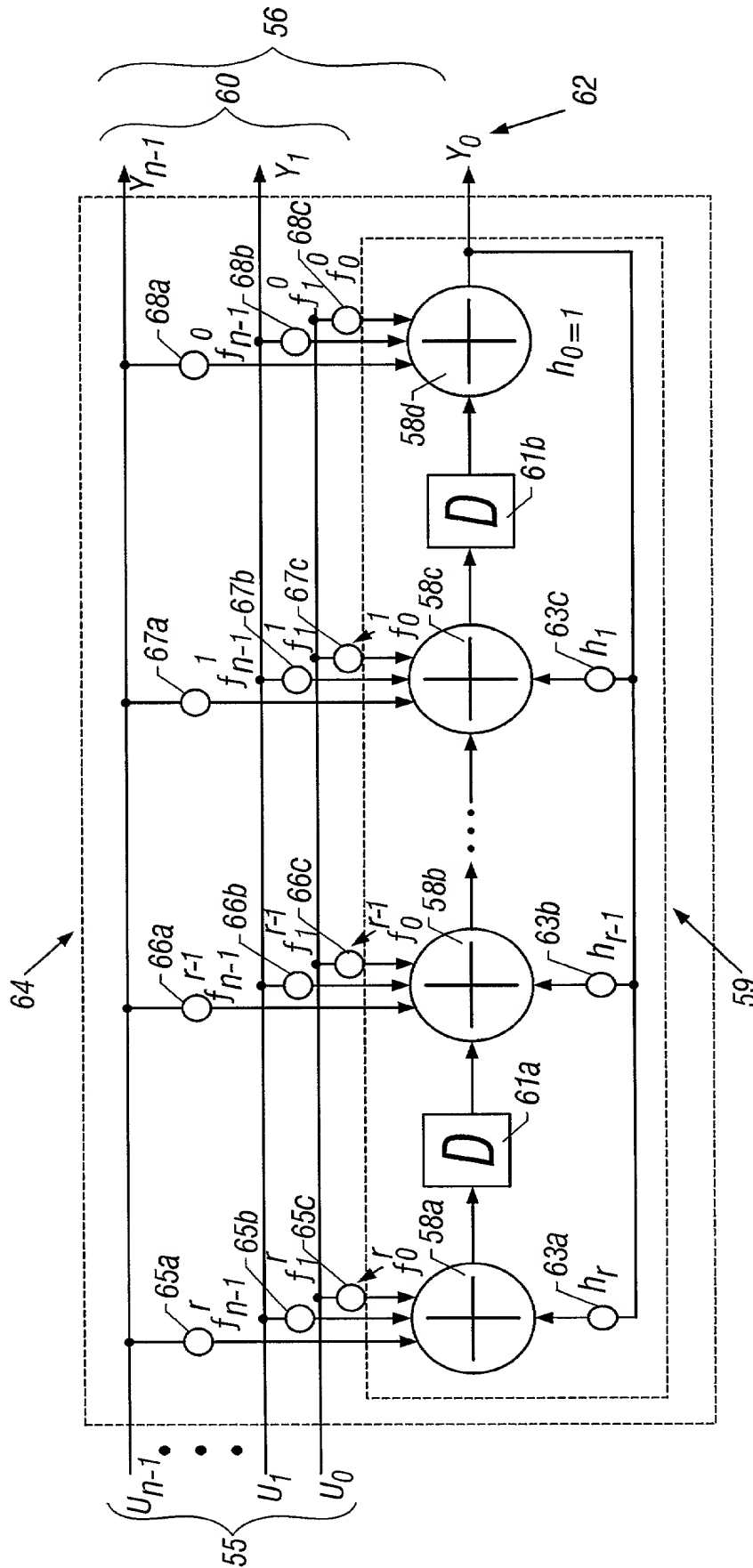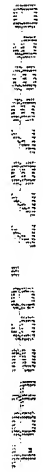Application No. 09/887,877

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Rate 8/9 overall 8-PSK SCTCM performance: rate 3/3 inner code
vs rate 6/6 inner code 15128-bit source data payload per block
(BER floor estimated using Union Bound)

FIG. 12C

Rate 4/5 overall QPSK SCCC performance: rate 2/2 inner code
vs rate 4/4 inner code 16384-bit source data payload per block
(BER floor estimated using Union Bound)

FIG. 12D

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
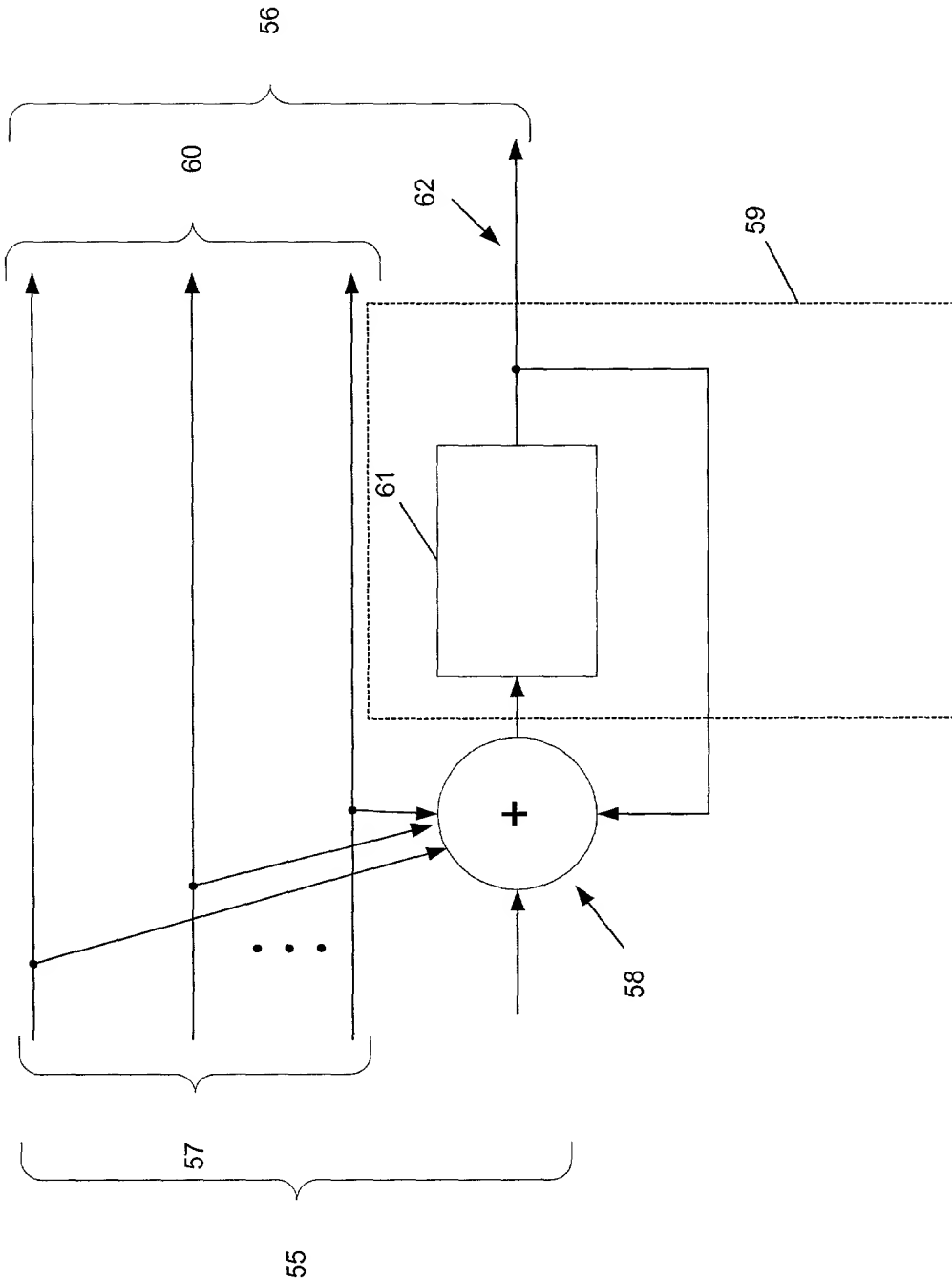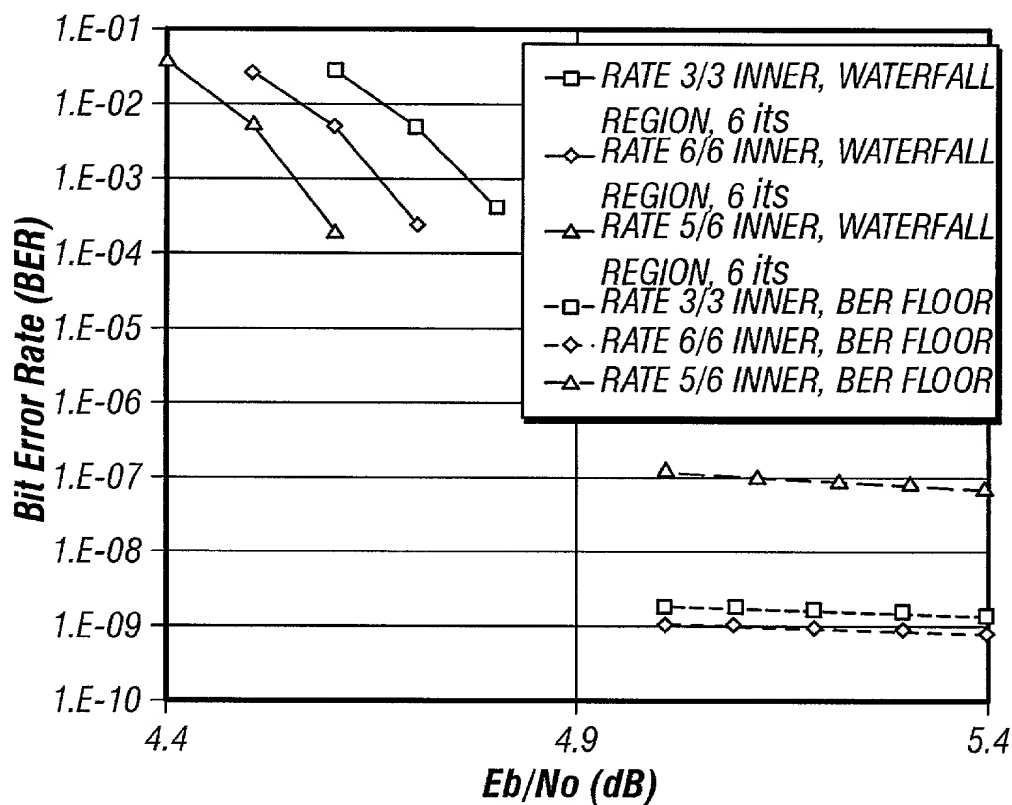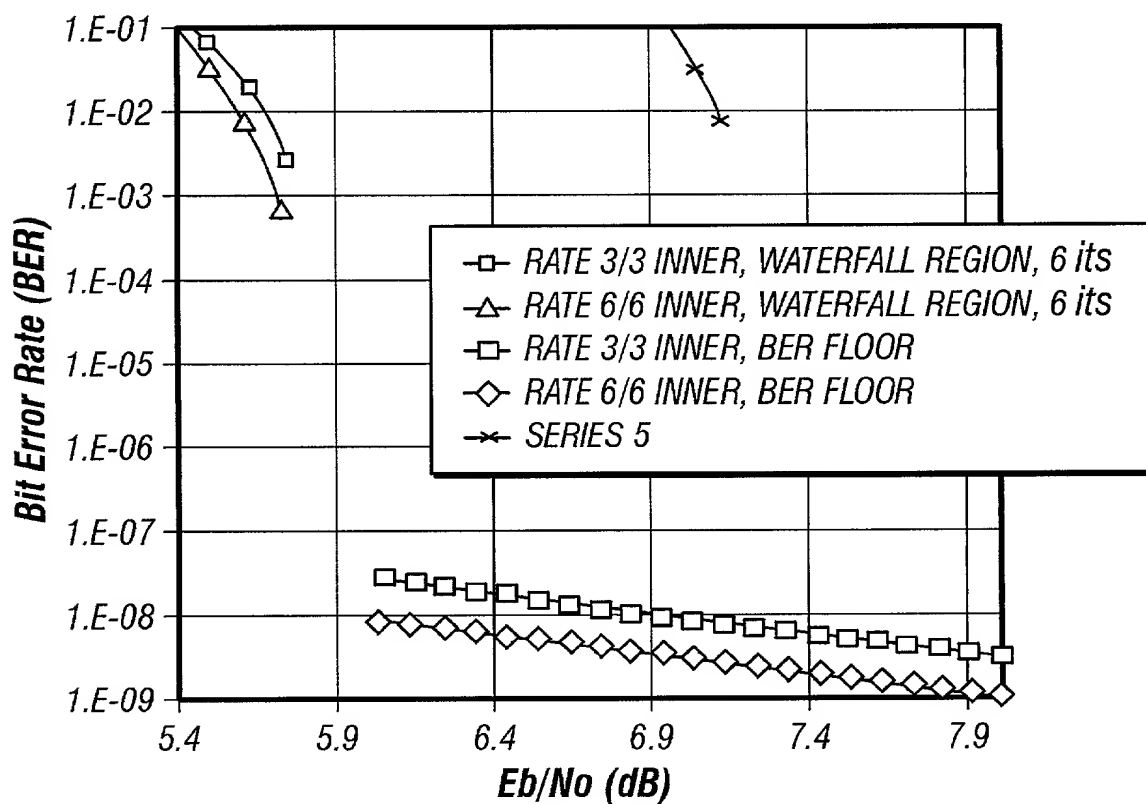Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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Simulated (Waterfall) Performance
Rate 2/3 Overall, 15144 source bits, 5 iterations

Legend:
- □ BASELINE RATE 5/6 INNER
- ◇ JPL'S BEST d2 RATE 5/6 $m=1$ INNER
- ✳ RATE 3/3 $m=1$ INNER, RATE 2/3 OUTER
- △ RATE 6/6 $m=1$ INNER, RATE 2/3 OUTER

Y-axis: Bit Error Rate (BER)
X-axis: Eb/No (dB)

FIG. 13A

Simulated (Waterfall) Performance
Rate 5/6 Overall, (15147 source bits per block, 6 iterations)

FIG. 13B

Rate 5/6 overall 8-PSK SCTCM
Performance: Rate 3/3 inner code vs rate 6/6 inner code

Legend:
- RATE 3/3 INNER, RATE 5/6 OVERALL, 6 *its*
- RATE 3/3 INNER, RATE 5/6 OVERALL, 6 *its*

Bit Error Rate (BER) vs Eb/No (dB)
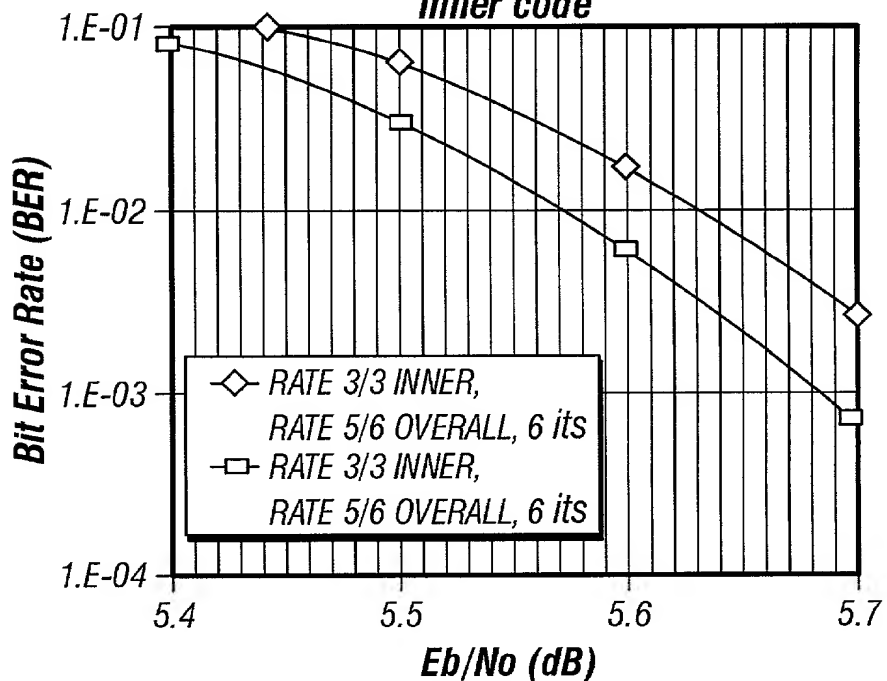
FIG. 13C

Rate 5/6 overall 8-PSK SCTCM
Performance: Rate 3/3 inner code vs rate 6/6 inner code

Legend:
- RATE 3/3 INNER, RATE 8/9 OVERALL, 6 *its*
- RATE 6/5 INNER, RATE 8/9 OVERALL, 6 *its*

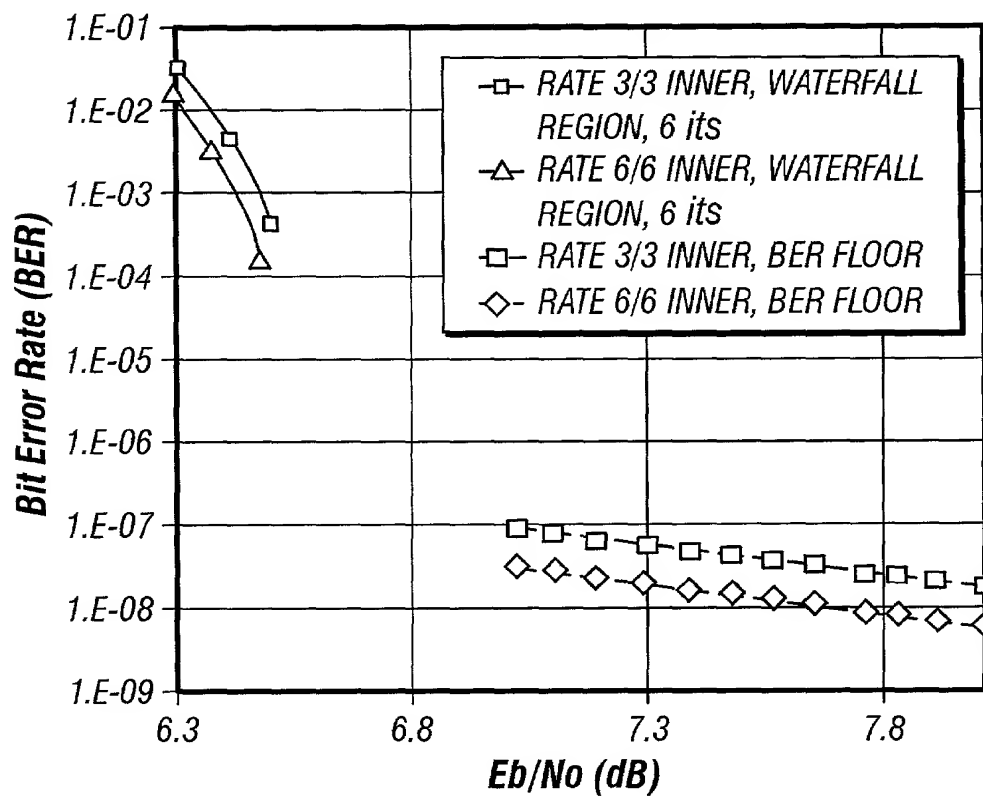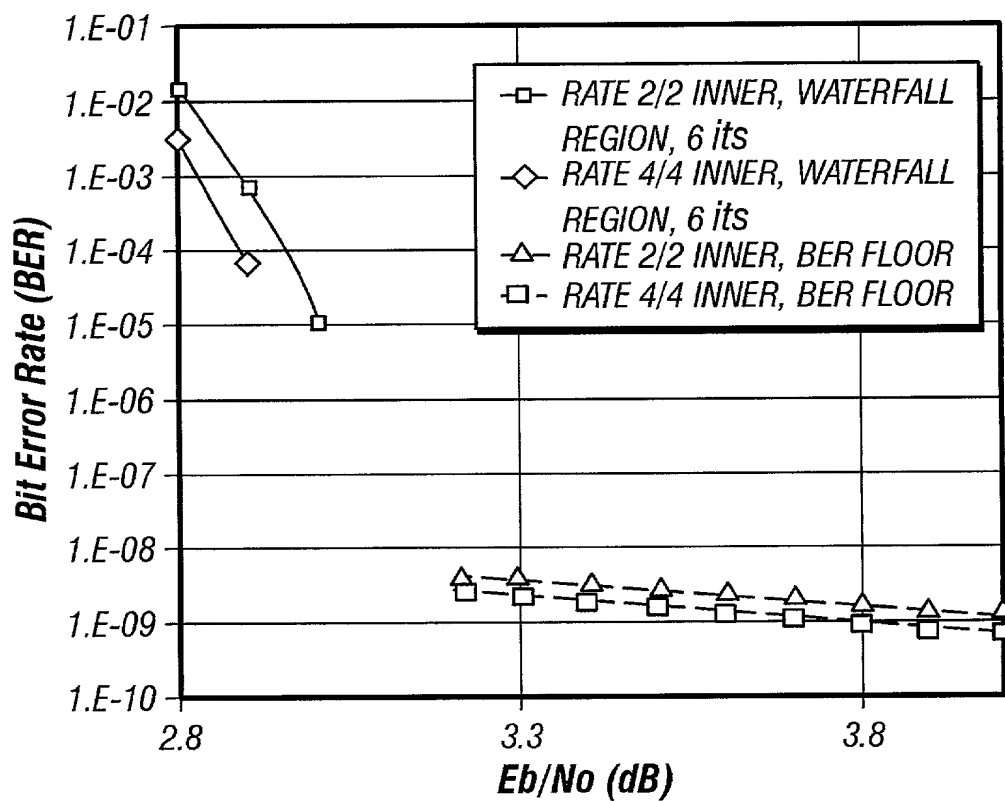Bit Error Rate (BER) vs Eb/No (dB)

FIG. 13D

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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INPUT

C	INNER SISO	C
U	115	U

116

DE-
INTERLEAVER
π^{-1}

117

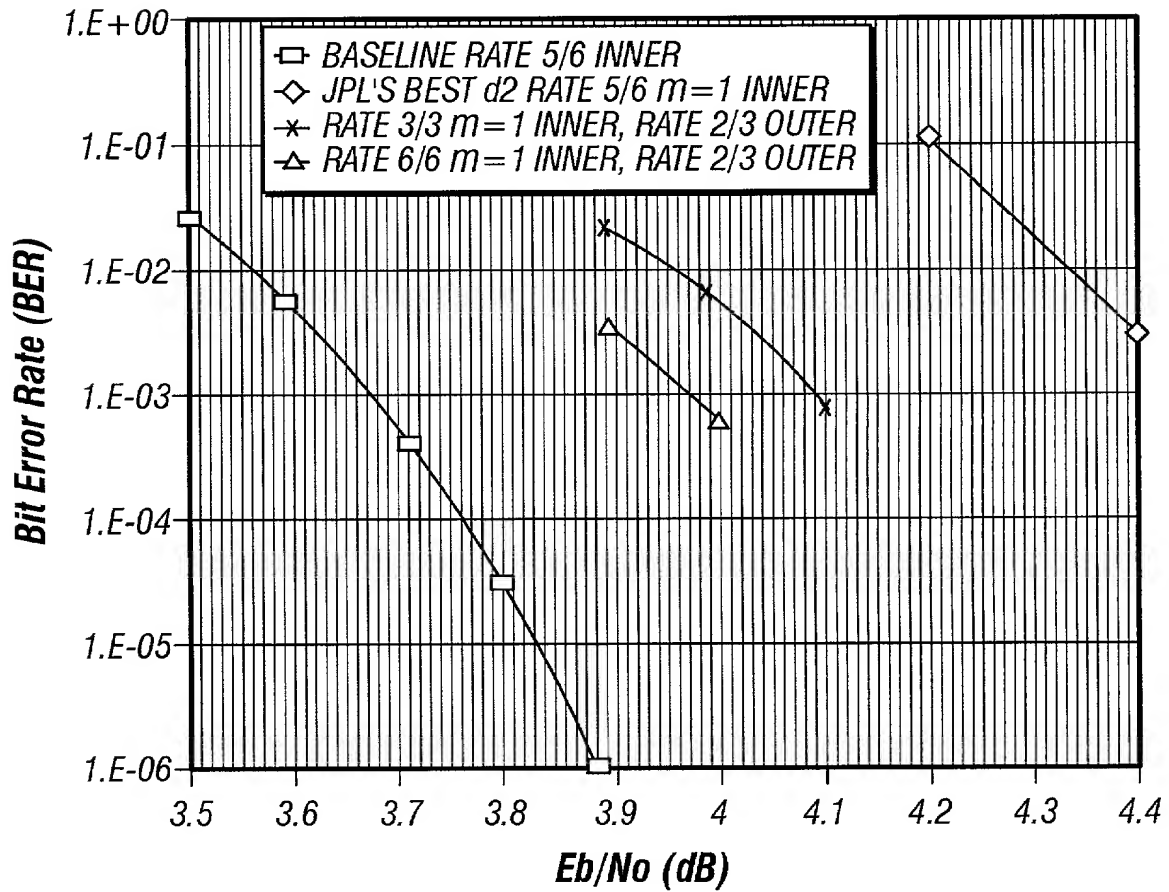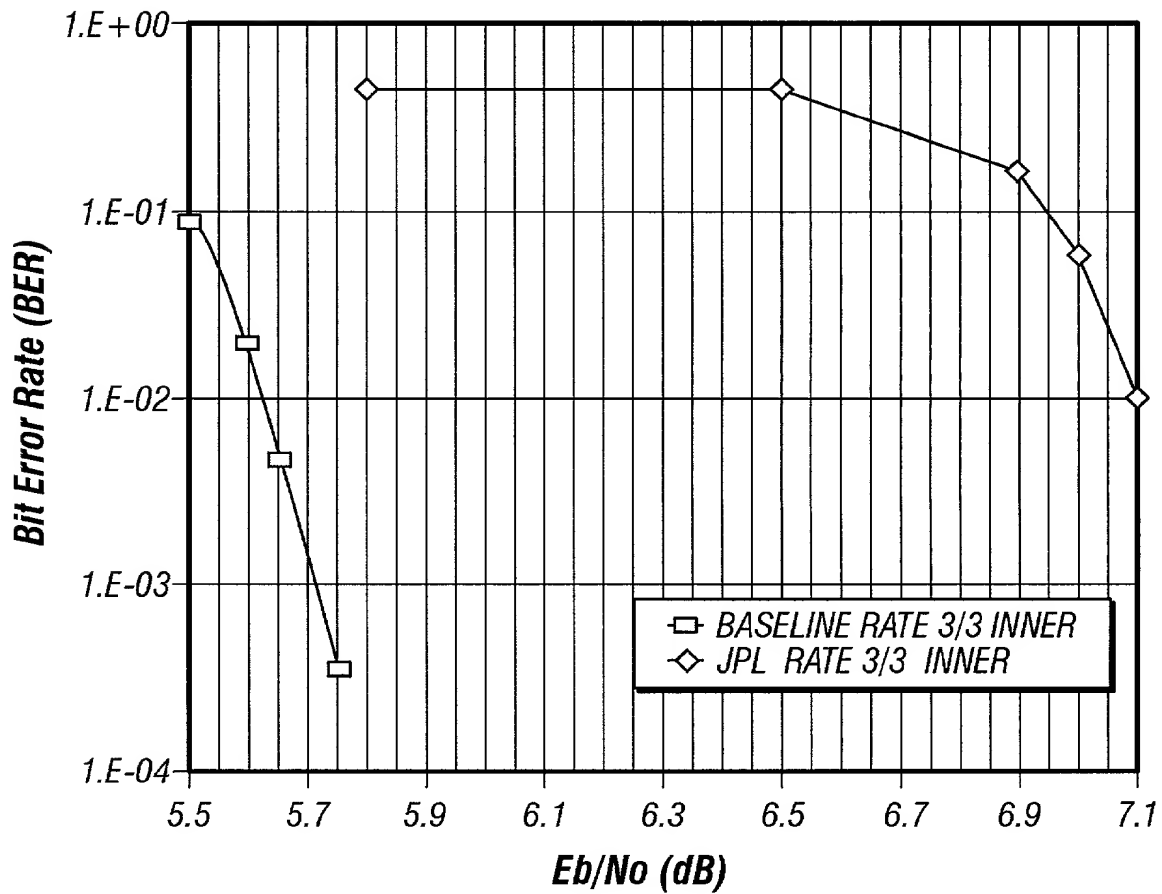| C	OUTER SISO	C
U		U

OUTPUT

118

INTERLEAVER
π

FIGURE 14

**RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER**
Inventors: Donald B. Eidson, et al.
Application No. 09/887,877

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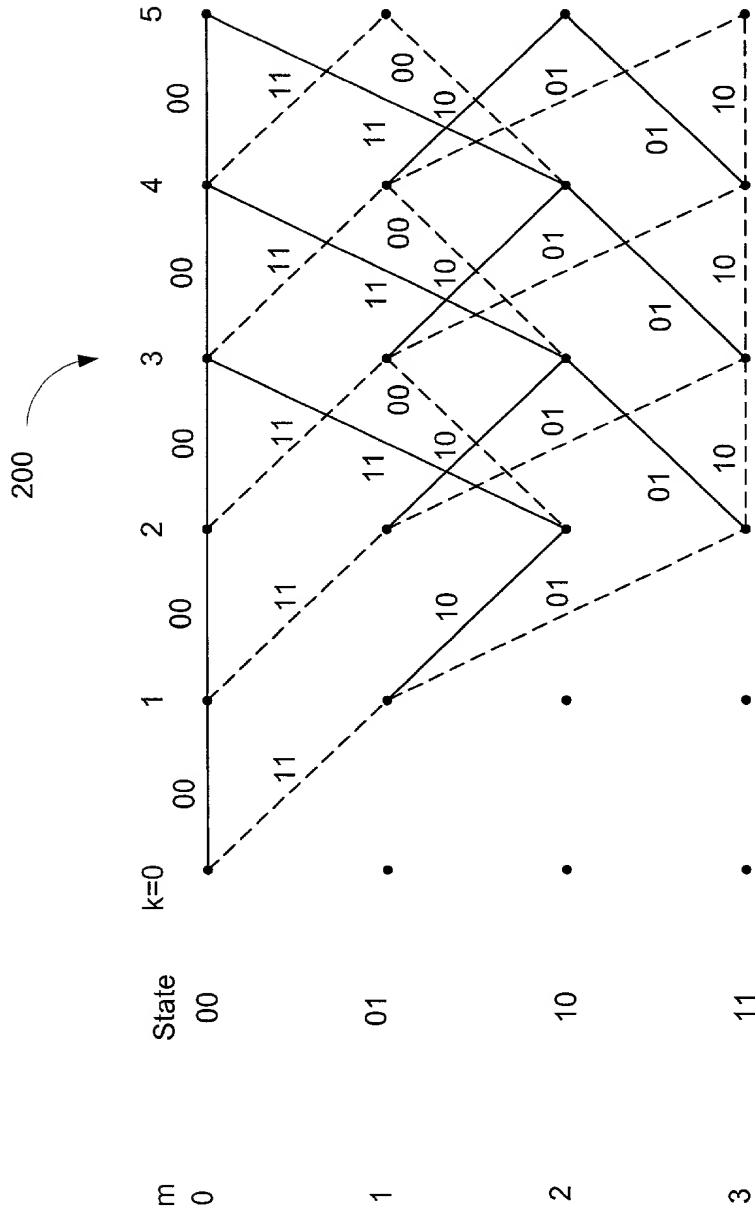
FIGURE 15

RATE N/N SYSTEMATIC, RECURSIVE CONVOLUTIONAL
ENCODER AND CORRESPONDING DECODER
Inventors: Donald B. Eidson, et al.
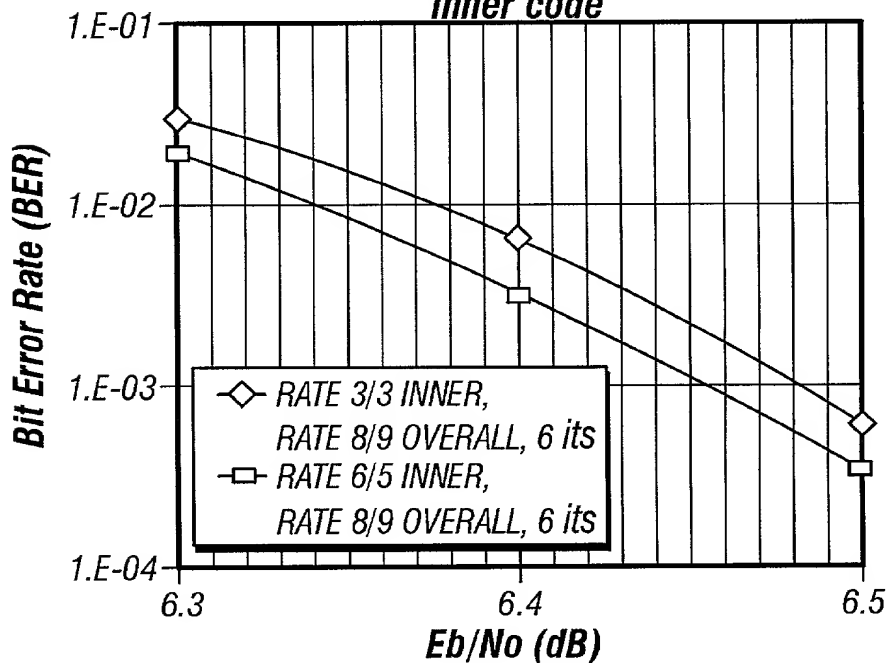Application No. 09/887,877

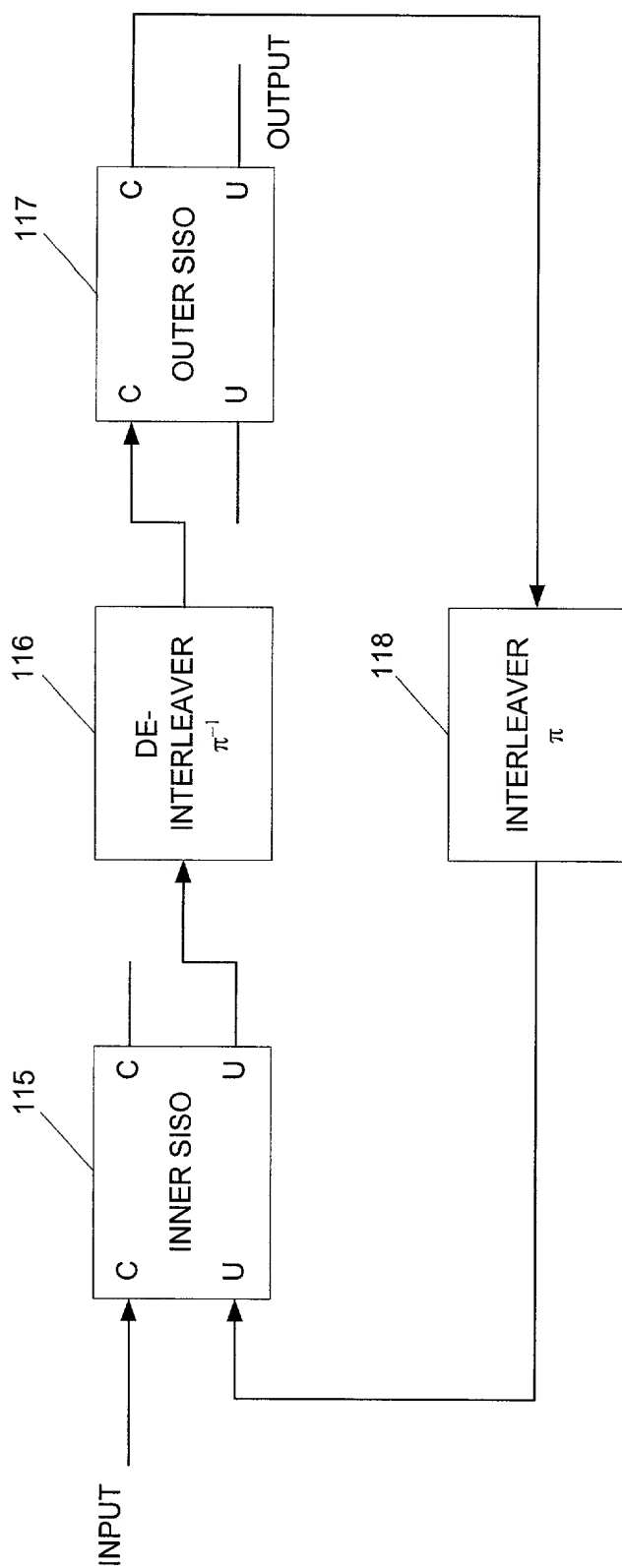**23/24**

121 — INITIALIZE $\alpha^i_0(m)$ AND $\beta_N(m)$

122 — FOR EACH OBSERVATION R_k, COMPUTE $\gamma_i(R_k, m', m)$ AND $\alpha^i_k(m)$

123 — AFTER COMPLETE SEQUENCE R^N_1 RECEIVED RECURSIVELY COMPUTE $\beta_k(m)$

124 — MULTIPLY $\alpha_i^k(m)$ AND $\beta_k(m)$ TO OBTAIN $\lambda^i_k(m)$

125 — COMPUTE LLR FOR EACH DECODED BIT d_k

FIG. 16

START

126 — IN INNER SISO, COMPUTE LLR FOR EACH UNENCODED BIT d_k

133 — SUBTRACT U INPUT TO FORM EXTRINSIC OUTPUT U

127 — PROVIDE AS A PRIOR INFORMATION TO OUTER SISO AFTER PASSAGE THROUGH DE-INTERLEAVER

128 — IN OUTER SISO, COMPUTE LLR FOR EACH CODED BIT C_n

134 — SUBTRACT C INPUT TO FORM EXTRINSIC OUTPUT C

129 — PROVIDE AS A PRIOR INFORMATION TO INNER SISO AFTER PASSAGE THROUGH INTERLEAVER

130 — MORE ITERATIONS ?

YES

NO

131 — IN OUTER SISO, DETERMINE LLR FOR EACH UNENCODED BIT d_n

132 — COMPARE WITH THRESHOLD TO DETERMINE FINAL ESTIMATE OF EACH UNENCODED BIT d_n

FIG. 17